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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/530,322	04/05/2005	Atsushi Watanabe	US01-04071PCT	3070

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EXAMINER	
HO, ANTHONY	
ART UNIT	**PAPER NUMBER**
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/530,322	WATANABE ET AL.	
	Examiner	Art Unit	
	ANTHONY HO	2815	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *25 April 2008*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1 and 4-6* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1 and 4-6* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

This is in response to amendment to application no. 10/530,322 filed on April 25, 2008.

Claims 1 and 4-6 are presented for examination.

Claims 2-3 and 7-10 have been cancelled.

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. **Claims 1 and 4-6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nagahama et al. (US 2005/0121679 A1) (hereinafter Nagahama), and further in view of Kano (US 6,388,275 B1)**.

Regarding claims 1, 5, and 6: Nagahama discloses (embodiment 2, col. 18-col. 25) and shows (fig. 2) a group III nitride semiconductor light-emitting element, a GaN based LED, including an n-type contact layer of GaN doped with Si (12, col. 20, lines 22-24), and n-type clad layer of AlGaN doped with Si (14; col. 21, lines 18-23), and active layer (16), a p-type clad layer (19), and a p-type contact layer (20), comprising a crack-preventing layer of InGaN doped with Si (13; col. 20 line 66 – col. 21 line 15) of n-type GaN-based materials, having a lower dopant concentration than that of the n-type contact layer (col. 20; lower to confine carriers in the contact layer, col. 20, lines 33- 42; though this refers to the cladding layer, the crack preventing layer has the same

physical concerns if included between the cladding layer and the contact layer, in order to confine carriers in the contact layer for lower resistivity), provided between the n-type contact layer (12) and the n-type clad layer (14).

Nagahama does not explicitly disclose the limitation such as the use of a GaN crack-preventing buffer layer wherein the crack prevention layer has a dopant concentration within a range of $5x10^{16}$ /cm^3 to $5x10^{17}$ /cm^3.

Kano teaches the replacement of an InGaN-type crack preventing layer with a superlattice-type crack-preventing buffer layer (5; col. 4, lines 18-27) formed of both materials that compose the n-type contact layer and the n-type clad layer (col. 1, line 30 – col. 2, line 44).

Kano is evidence that ordinary workers in the art would find a reason, suggestion, or motivation to use a crack-preventing layer with a superlattice.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the structure imparted by Nagahama by using a crack-preventing layer with a superlattice, since Kano teaches this improvement is more closely matches the two lattice constants (between GaN and AlGaN) than does a crack-preventing layer of InGaN (col. 1, lines 30-43).

When applied to the device of Nagahama, layers of GaN and AlGaN are stacked alternating in composition so that the crack-preventing buffer layer is provided. This concept, when applied the GaN:Si and AlGaN:Si layers, the resulting crack prevention layer may be considered to be a GaN crack preventing layer, as it comprises GaN. Alternatively, if each layer in the crack-preventing buffer layer is considered to be its

own crack preventing layer, then the claimed crack-preventing layer may be the first GaN layer of the periodic structure.

Still lacking form Nagahama as modified by Kano is the n-type contact layer within a range of $5x10^{16}$ /cm^3 to $5x10^{17}$ /cm^3. The concentration of dopants is a results effective variable, as this system may be adjusted to increase carriers in the contact layer, allow for ohmic contact and acceptable threshold voltages, and to select the optimum range of leakage current and series resistance (evidenced by disclosure of Nagahama; col. 20, lines 24 - 38).

Thus, these claims are prima facie obvious without showing that the claimed ranges achieve unexpected results relative to the prior art range. In re Woodruff, 16 USPQ2d 1935, 1937 (Fed. Cir. 1990). See also In re Huang, 40 USPQ 2d 1685, 1688 (Fed Cir. 1996) (claimed ranges of a results effective variable, which do not overlap the prior art ranges, are unpatentable unless they produce a new and unexpected result which is different in kind and not merely in degree from the results of the prior art). See also In re Boesch, 205 USPQ 215 (CCPA) (discovery of optimum value of result effective variable in a know process is ordinarily within the skill of art) and In re Aller, 105 USPQ 233 (CCPA 1955) (selection of optimum ranges within prior art general conditions is obvious).

Further, this dopant concentration range would be less than any preferred dopant concentration in the contact region. Thus, the contact region will have a greater dopant concentration than the crack preventing layer, even if Applicant can show that the greater concentration is not required to confine carriers in the contact layer.

Regarding claim 4, Nagahama discloses that the contact layer may have a dopant concentration of range of $1x10^{17}$ /cm^3 to $1x10^{21}$ /cm^3, preferably range of $1x10^{18}$/cm^3 to $5x10^{19}$ /cm^3, overlapping the claimed range of $4x10^{18}$ /cm^3 to $2x10^{19}$/cm^3. In the case where the claimed ranges "overlap or lie inside ranges disclosed by the prior art" a prima facie case of obviousness exists. In re Wertheim, 541 F.2d 257, 191 USPQ 90 (CCPA 1976); In re Woodruff, 919 F.2d 1575, 16 USPQ2d 1934 (Fed. Cir. 1990).

Response to Arguments

Applicant's arguments filed April 25, 2008 have been fully considered but they are not persuasive.

In response to applicant's arguments against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.,* 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986).

Applicant asserts that the claimed range of range of $5x10^{16}$ /cm^3 to $5x10^{17}$ /cm^3 is not disclosed by Nagahama. However, as explained in the rejection above, the dopant concentration in the contact region is a result effective variable, and thus the claimed range is obvious absent a showing of unexpected results. For example, Nagahama discloses that the concentration of dopants in a GaN layer may be in a range of $1x10^{17}$ /cm^3 to $1x10^{21}$ /cm^3. Applicants argue that "Nagahama et al merely discloses this range of the dopant concentration in connection with the contact layer, not with a crack-

preventing layer" (see page 5, paragraph 1 of Applicant Arguments/Remarks dated April 9, 2008). However, in the present application, the crack-preventing layer comprises GaN and the disclosed concentration applies in this case (see column 20, lines 24-38 in Nagahama et al).

Applicant further states that one of ordinary skill in the art would not dope a crack preventing layer in this range due to the increase in resistance. However, it has been established that lower dopant concentrations have benefits (better crystal quality and lower leakage) as well as drawbacks (increased resistance), and that this range is available to be optimized by an individual skilled in the art.

Applicant argues that "one of ordinary skill in the art would focus on the increase in resistance...when determining a dopant concentration of the crack-preventing layer. So it would have been natural for one of ordinary skill in the art to adopt higher dopant concentration for avoiding the drawback of increased resistance" (see page 6, last paragraph – page 7 of Applicant Arguments/Remarks dated April 9, 2008). However, this assertion by applicant is not convincing since higher concentration causes “leak current in the device increases and the quality of crystal deteriorates, resulting in a shorter device life” (see column 20, lines 31-33 in Nagahama et al).

In addition, applicant argues that “[t]he Examiner seems to simply state that 'leakage current' is decreased by decreasing a dopant concentration in the context of an integrated circuit” (see page 3, paragraph 4 of Applicant Arguments/Remarks dated April 25, 2008). However, this argument by applicant is not convincing since Nagahama

et al teaches the "leakage current" in the context of a laser device (see column 20, lines 27-31 in Nagahama et al).

The concept of having a contact layer with a low dopant concentration is not claimed, but rather a range which Applicant asserts in arguments is low. Regardless, the dopant concentration in the contact layer has been established as a result effective variable and is obvious absent a showing of unexpected results.

Thus far, applicant has not shown unexpected or unpredictable results in regards to having the claimed range of dopant concentration in the crack-preventing layer. Arguments made by applicant are well known and well established in the art and are also taught by Nagahama et al (see column 20, lines 24-38). Thus, the claimed invention is prima facie obvious over the combined references of Nagahama et al and Kano.

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of

the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to ANTHONY HO whose telephone number is (571) 270-1432. The examiner can normally be reached on M-Th: 10:30AM-9:00PM EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Kenneth Parker can be reached on 571-272-2298. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/A. H./
Examiner, Art Unit 2815

/Jerome Jackson Jr./
Primary Examiner, Art Unit 2815